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The Genus *Scolops* (Homoptera, Fulgoridæ).*

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INTRODUCTION.

WHILE making a systematic study of the Fulgoridæ indigenous to the Middle West, the writer became aware of the fact that much confusion and uncertainty existed among taxonomic workers as to the species in the genus *Scolops*. In many publications species have been erroneously named and classified. Few writers working with the group have had a clear species concept for the genus, and as a result the mistakes of a predecessor have often been perpetuated. While it is true that several workers have had such a conception, their findings and conclusions have not been published. It was with the aim of untangling the situation and of bringing the genus up-to-date that the following studies were undertaken.

The writer wishes to acknowledge his indebtedness to those who have assisted him in his work: To Dr. P. B. Lawson, at whose sug-

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gestions the studies were undertaken and under whose guidance the work was done, he feels the greatest obligation and deepest gratitude; to Dr. H. B. Hungerford, whose sympathetic interest has been a source of continuous inspiration; to Dr. E. D. Ball, who was so generous in the loaning of material, and whose suggestions added much to the progress of the studies; to Mr. W. E. China, of the British Museum, who so graciously extended the assistance he could command; and to each of the following, for the loan of much valuable material: Prof. Herbert Osborn, Prof. C. P. Gillette, Prof. Z. P. Metcalf, Mr. W. J. Gerhard, Dr. S. A. Rohwer, and Dr. T. H. Frison he is very grateful.

DISTRIBUTION.

The genus *Scolops* Schaum, as known at present, is limited to North America. It is best known from the plains region of the temperate zone lying just east of the Rocky Mountains, although its range is now indicated by the following outlying points: Maine on the northeast; Florida on the southeast; Monterey, Mexico, on the south; Nogales, Ariz., on the southwest; California on the west; and Enderby, British Columbia, on the northwest. Uhler's genus *Belonocharis,* which will be treated as a subgenus in this paper, is known only from west of the Rocky Mountains. The range of this group seems to be typically west of and outside of that of the former. Representatives of *Belonocharis* have been examined from Tia Juana, Mexico, on the south; Wenatchee, Wash., on the north; and Rifle, Colo., on the east.

LIFE HISTORY NOTES.

No work seems to have been done toward determining the life histories of the insects in this interesting group. According to the labels on the specimens before the writer, adults occur throughout the summer in this locality from the middle of June to the last of September. Three pairs in copula are before the writer, one pair of *S. hesperius* bearing the date August 8, and two pairs of *S. sulcipes* bearing the date August 10. Females of several species that were known to be carrying ova were selected for dissection, with the hope of finding some suggestions as to oviposition habits. All were dated late in August or early in September. The ova were found to be large and few in number, measuring on the average from 1 mm. to 1.25 mm. in length, and about 0.5 mm. at the greatest diameter. The greatest number of ova taken from any one individual was 12 and the least 5, while the average was around 7. The ova were elongate-

oval in shape and quite granulose in appearance. It hardly seems probable that the eggs are inserted in the woody tissues of plants, for the ovipositor of the female is certainly not constructed for such an operation, since the blades are thin and membranous. From this point all is speculation as to how and where the eggs are placed.

COPULATION. Attachment for the copulatory act is made about as follows: The eighth abdominal sternite of the female has become divided along the median line, and from the mesal ends of the halves there projects caudad a pair of appendages, the valves of the ovipositor. These apparently have little to do with the sexual act itself. The posterior margin of each half of this sternite is notched mesad, and it is these narrowed portions that the male grips by placing the hooks of his parameres in the notches on the caudal margins, and bringing the anterior margins of the sternite up against his pygofer hooks. Having done this he is now on his back. The seventh abdominal sternite of the female is provided with a well developed ridge on the anterior margin. The anal plate of the male is bifid on the caudal extremity, and the two halves are turned down forming a pair of hooks. An additional hold on the female is secured by placing these hooks on the anal plate over the ridge on the anterior margin of the seventh abdominal sternite of the female. The ædeagus of the male is then inserted between the valves of the ovipositor. (See Pl. LXIII, Fig. 4.)

HABITAT AND HOSTS.

The habitat of the group seems to be restricted typically to moist places near the edge of woodland and to low spots in the prairies that have been undisturbed, and where vegetation has been allowed to make a rank growth. The presence of these insects seems to depend more upon the nature of the vegetation than upon its topographical location, for the writer has had very profitable collecting on hilltops on the prairies, far removed from any such moist situations. *S. sulcipes* seems to prefer *Solidago* and *Helianthus,* although it is often found in places where *Ambrosia artemisifolia* is dominant. *S. pungens* has been secured in quantities from nearly pure stands of *Ambrosia artemisifolia. S. luridus* was secured from nearly pure stands of *Artemisia,* probably *ludoviciana,* early in September. They are rarely taken in grasslands, and are not to be taken in quantities as are the species of other groups. Since they are collected by the sweeping method it is difficult to say on what particular plants they are living, for the vegetation swept normally consists of a variety

of species. It has been found that short, swift strokes of the net, well down into the vegetation, brought the best results, since the insects are shy and very agile in their movements.

SPECIFIC CHARACTERS.

Since confusion has existed among many writers as to what constituted good specific characters, a survey was made of the group to determine what characters were specific and to what extent they were reliable.

VEINS OF TEGMINA. The presence or absence of fuscous markings on the costal cell of the elytra proved to be constant for the species. On these characters it was possible to separate the species of the genus into two nearly equal groups. In some species the veins of the tegmina are concolorous, while in others they are marked in various ways and degrees. Forking of the veins does not offer characters that vary widely enough between the species to be useful.

HEAD AND PROCESS. In a number of species the head is set close up against the pronotum, while in others it is more distant, with somewhat of a constriction behind the eyes. The length of the cephalic process as compared with that of the front, its width as compared with that of the vertex, and its general shape, offer good specific characters. To say that the process is long or short, stout or slender, is ambiguous; but to limit the term "long" to mean as long as the front or longer, and "stout" to mean three-fourths as wide as the vertex or wider, conveys meanings that are tangible. The above terms and others that appear in the descriptions, included as a part of this paper, have been restricted in their meanings, in so far as possible. (See Pl. LXIII, Fig. 1.)

COLOR. Colors and color patterns furnish excellent auxiliary characters. The insect can be considered as having a typical ground color on which are imposed fuscous markings which vary greatly in number, size, density of color, shape of outline, and position on the body, among the species, but are typical within the species. The ground color, together with the fuscous markings, give to the insect a characteristic appearance. It is possible for these fuscous markings to vary greatly in density of coloring, as is shown by the extreme case of *S. pungens*. This is truly, in several respects, a widely varying species, as will be pointed out later. Some species are seemingly devoid of color patterns, while others are richly supplied. The presence or absence of fuscous bands on the fore and middle tibiæ have proven of value as specific characters.

MALE GENITALIA. Studies of the male genitalia of the group revealed specific characters which are practically constant within the species, as shown by the examination of a long series of individuals, in each case where abundant material made such possible, and which will add much to the definiteness of classification. The characters are not at all difficult of access in case one needs to appeal to them in definitely placing an insect systematically. The accompanying drawings are a valuable part of the paper, for there it has been possible to give information many pages of writing would fail to disclose.

SEXUAL VARIATION. The difference in the sizes of the sexes is much more pronounced in some species than in others. The males of *S. grossus* appear to have about half the body bulk of the females, while those of *S. sulcipes* are normally only slightly smaller than the females. In every known case but one the relative body measurements hold regardless of the difference in the sizes of the two sexes. The cephalic process of the male of *S. flavidus* var. *pellos* var. n. is not typical of the species, being proportionally much shorter. At first this unusual variation was thought to be due to some accident the insect had had during metamorphosis, but on careful examination the process seems to have had normal development.

DIMORPHISM. Considerable confusion has arisen in the past due to the fact that both macropterous and brachypterous forms occur in the same species, and at the same time. The brachypterous form is by far the more common, and at the present time certain species are known only from that form, while the other form probably exists and will come to light in the future.

WING VENATION.

Metcalf*, in 1913, discussed the wing venation of the Fulgoridæ, from which studies the following summary for the genus *Scolops* will be drawn:

Costa of the fore wing is typically unbranched, usually of somewhat less extent than subcosta. Subcosta lies parallel with radius for its entire length, and both are unbranched. Media is typically two-branched, although these branches may divide again before reaching the apex of the wing. Cubitus is typically two-branched, while the first anal vein is unbranched. The second anal vein is unbranched, while the third anal vein forks once, the inner branch uniting with the second anal vein toward the apex.

* Metcalf, Z. P. The Wing Venation of the Fulgoridæ. Annals of the Entomological Society of America: VI, No. 3; 1913.

Costa of the hind wing is present only as a weak vein at the base of the wing. Subcosta appears merely as a weak vein lying parallel with the radius along its base. Radius is typically unbranched, although in this group it shows a tendency to branch near the apex of the wing. Media is typically two-branched, as is also cubitus. The first anal vein is unbranched, as is also the second anal vein which lies parallel with it, while the third anal vein is typically three-branched. (See Pl. LXIII, Fig. 2.)

DESCRIPTIONS.

When preparing a monograph of any group it is desirable, when possible, to point out specific characters when describing and redescribing the various species, excluding as many of those characters of a general nature as possible. It is possible to do this by following a uniform plan in writing the descriptions. One must also bear in mind that it is often the combination of specific characters rather than the characters themselves that is important in determining a species. The terminology used is very important, and an effort has been made to be consistent and strict in the use of terms, employing those that have come to be accepted and used by the authorities working in related fields.

MEASUREMENTS. Body measurements have been employed only as gross indicators. The length of the body has been restricted to mean the distance from the sulcus to the tip of the telson. The term "sulcus" as here used refers to the transverse groove that separates the front from the cephalic process. Wing lengths have not been used since they were found to be too variable. Body width has been restricted to mean the greatest width across the body just caudad of the tegulæ. The length of the front means its greatest length, which includes the latero-posterior angles. Comparative measurements have proven much more reliable and therefore are much to be preferred to actual measurements. Such have been used whenever they were found to offer specific characters.

COLOR. To describe a color or color combination has presented one of the most difficult phases of the present studies. In describing the color charateristics of each species the writer has striven for consistency and accuracy, knowing full well that what may be interpreted by one reader in one way may receive a different interpretation from another. Whenever possible the coloring of recently collected material has been made the basis of the description.

TECHNIQUE FOR PREPARING SPECIMENS.

The most satisfactory method for preparing material for study is about as follows: After the labels have been removed from the mounted specimens, it is placed, pin and all, in boiling water and allowed to remain for a few minutes only. Care should be taken to have the heat so regulated that the water is not bubbling. If the specimen is mounted on a paper point it will come loose; and if not, it will be easy to remove the pin from the relaxed insect without causing damage. The labels should be placed on a pin, together with a number corresponding to that on a bottle to which the relaxed specimen is transferred, and preserved for future use and reference. A quantity of a solution of ten per cent alcohol is placed in the bottle containing the relaxed specimen. After the specimen has remained in this solution over night it is sufficiently relaxed for study.

To mount the specimen for study it is necessary to pin it down on a paraffin dish in such a way that a true lateral view of the genitalia may be obtained. A suitable paraffin dish may be prepared by filling the lid of a small tin box with paraffin, and as the paraffin cools making a depression in it by pressing with the thumb. The specimen is pinned on its left side near the margin of this depression by first inserting a pin in the groove between the middle and hind coxæ; second, by lifting the wings on the right side and inserting a pin under them on a slant, so that it holds the wings from over the genitalia and prevents the specimen from sliding up on the first pin; and third, by placing a pin on either side of the head in such a way that the specimen is made rigid. The specimen need not suffer the least injury, since it is not necessary to pierce the body wall or appendages. With the specimen fixed in this position it is ready for examination under the binocular. Enough water should now be placed in the depression to completely cover the specimen so that a clear, undistorted view is obtained. The genitalia can be opened by pulling the anal plate and parameres away with a dissecting needle.

As soon as the necessary studies have been made the specimen should be returned to its vial, and absolute alcohol added in place of the former solution, for desiccation. After remaining in the absolute alcohol for twenty-four hours, xylol should be substituted, and it allowed to stand for another twenty-four hours. From the xylol it can be remounted as before and the proper labels returned. By following such a procedure the specimen is damaged very little,

if any. Greenish colorings will be destroyed, but the fuscous colorings and markings will be practically unchanged. Some bleaching will result from the absolute alcohol, but this is much to be preferred to removing the genitalia from the specimen. The genitalia of holotype specimens have been studied by the above method, when one would hesitate to undertake such studies if to do so it were necessary to remove the genitalia, with the subsequent damage to the specimen.

MALE GENITALIA.

The male genitalia of the genus fall typically into three groups. For the sake of comparison and reference these will be designated as the *sulcipes* group, the *grossus* group, and the *Belonocharis* group. In structure they are typical of the Dictyophorinæ, and consist primarily of a median tubular organ, the ædeagus, and a pair of lateral appendages, the parameres. The nomenclature adopted is essentially that accepted and used by the authorities of to-day.

ÆDEAGUS. This organ in *Scolops* seems to consist of a pair of appendages, subsequently united dorsally and ventrally, in the form of a tube. Such a development is not so evident in *Belonocharis*. In *Scolops* the distal ends of these appendages have bladelike structures that are stiffened with chitin. These have been termed the ventral blades, and show characters of structure that are constant for the species, which should aid materially in classification and in arranging the species phylogenetically. Dorsad of the ventral blades and between them project the conjunctiva appendages. These appendages are present and well developed in *Beloncharis*, while the ventral blades are entirely wanting. In the *sulcipes* group the conjunctiva appendages are short and do not extend beyond the ventral blades, but in the other groups they are longer and have a characteristic appearance for each. Those of *Belonocharis* are well developed and stand almost at right angles to the longitudinal axis of the ædeagus. The identity of the *grossus* group is readily established by the appearance of these appendages, which are slender, long, and bent dorso-cephalad until they point in almost the same direction as the longitudinal axis of the ædeagus. The shape of the unchitinized part of the ædeagus depends much on the relaxing, and cannot be relied upon for specific characters.

PYGOFER HOOKS. It will be noted that the latero-posterior angles of the pygofer in *Scolops* have been drawn out and folded laterally, so that a stout, heavily chitinized hook has been formed. *Belonocharis* does not have such a hook, for while the latero-posterior angles

have been drawn out, no lateral bending has taken place. These hooks, in general appearance and relative position with respect to the pygofer, offer auxiliary characters that are of value in placing a species systematically.

PARAMERES. These are a pair of appendages that lie on either side of the ædeagus, inclosing it laterally and ventrally when it is not in use. The lateral hooks on these appendages are not set so far caudad in *Belonocharis* as in *Scolops*. The parameres offer characters in shape and appearance that are constant for the species.

ANAL PLATE. The tenth (X) abdominal segment constitutes a flattened, bilobed organ which has been designated as the anal plate. Attached to the eleventh (XI) segment is the telson (anal style). The anal plate is more or less bifid dorsad, folded somewhat ventrally, forming a dorsal covering over the ædeagus and parameres when the genitalia are not in use. This organ offers characters in outline that are of specific value, but fails to show group differences. (See Pl. LXIII, Fig. 5.)

SPECIES IN SYNONYMY.

With a large series of specimens available for examination, representing *S. spurcus* Uhler and *S. desiccatus* Uhler, it became increasingly difficult to determine the dividing line between the two. Numerous specimens were studied from north, south, east and west; and one extreme, represented by *S. spurcus*, gradually graded over into the other, represented by *S. desiccatus*, when external characters were used. An examination of the male genitalia of a long series of specimens taken from both extremes disclosed no essential specific differences. It appeared that Uhler had described as two distinct species the extremes of a widely distributed species as represented by a brachypterous form from Texas and a macropterous form from Maryland.

To carry the studies to their final conclusion, the types were secured from the National Museum. Uhler had made females holotypes; but along with these came males from the same localities as the types and of the same form, bearing determination labels in the same handwriting as that on the type labels. These male specimens were prepared for study, and lateral views of the opened genitalia were drawn. When these drawings were compared they proved to be nearly identical. With the genitalia as a working base the species was studied in greater detail, and the following conclusions were reached: The species is a widely varying one, both as regards body

size and color density. The color pattern remains essentially the same as do the proportionate body measurements. The apparent size of the insect varies much, due partly to the appearance of a number of macropterous individuals and undersized brachypterous males. Certain specimens appear almost black, while others have a yellowish-grey appearance. A careful examination shows the difference to be almost wholly a matter of color density, the pattern remaining essentially the same. *Scolops desiccatus* then is a synonym of *S. spurcus*.

About the time these studies were finished Mr. Z. P. Metcalf forwarded for study the holotype of his *S. parvulus*. When examined the genitalia of this specimen proved to be almost identical in every detail with those of *S. spurcus* Uhler and *S. desiccatus* Uhler. Since this specimen was a small brachypterous male, its actual body measurements would not agree with those given by Uhler for *spurcus*, but the color pattern was essentially the same as were the comparative body measurements. When compared with the types of *S. spurcus* and *S. desiccatus*, outside of being smaller in size, it displayed no essential specific differences. It, too, is a synonym of *S. spurcus* Uhler.

S. spurcus Uhler must be a synonym of Germar's *pungens*. The following arguments will be cited in support of the above conclusion. In describing *pungens* Germar gives its size as half that of *Dictyophora pannonica* Cruez. Specimens of *D. pannonica* were measured, and it was found that the body length was about 12 mm., which would give *S. pungens* a body length of 6 mm., and Uhler gives 5.5 to 6 mm. as the body length of *S. spurcus*. Germar states that *S. pungens* has "a slender, upturned stylus a little longer than half the length of the body, with the apex truncated." Such a description would fit the frontal process of Uhler's *spurcus* very well, and does not contradict his description in the least. The description of the thorax of *S. pungens*, while not so detailed, is essentially that of *S. spurcus*. Yellowish is given as the ground color of *S. pungens*, which would more nearly fit *S. desiccatus* than *S. spurcus*. In describing the elytra of *S. pungens*, Germar states that they are "yellowish, with white and black points, the apical margin variegated with fuscous." Such a description would fit the elytra of either *S. spurcus* or *S. desiccatus*.

Kentucky was given as the type locality of *S. pungens*, and of the species known to occur there, the description of the process rules out all but *S. sulcipes* Say and *S. spurcus* Uhler. Since the apical mar-

gins of the elytra of *S. sulcipes* cannot be considered as being variegated with fuscous, and the tip of the process cannot be considered truncated, in the sense that it is in *S. spurcus*, Germar certainly did not have *S. sulcipes* before him when he wrote his description.

Fowler's *cockerelli* is another species about which much uncertainty has existed. The original description means little or nothing. Fowler states that his description was based on a single female specimen collected on the northern frontier of Mexico, but Mr. W. E. China, of the British Museum, finds that this specimen is a male. Specimens of the following species, which seemed to be close to *S. cockerelli*, namely, *S. maculosus* Ball, *S. perdix* Uhler, *S. uhleri* Ball, *S. robustus* Ball, *S. snowi* sp. n., and *S. austrinus* sp. n., were sent to Mr. China for comparison with the type. Mr. China very graciously made the comparisons requested, and in discussing his findings wrote: "*S. cockerelli* comes nearest to *robustus*, but the insect is broader across the base of the tegmina, and the cephalic process is longer and thicker than in *robustus*." He also went to the trouble to prepare many drawings to illustrate the difference that existed between the type of *S. cockerelli* and the species sent for comparison.

Dr. F. H. Snow, while on one of his trips into the Southwest, collected many specimens of the insects in this and allied groups, among them two species of *Scolops* new to science and a good series of *S. robustus*, all of which were secured in Southern Arizona. An examination of the specimens of *S. robustus* revealed that they varied somewhat in size, and that the process became proportionately longer and stouter as the size increased. It was found that a somewhat similar variation occurred among the cotypes, but a careful study of the genitalia of specimens from the extremes removed any doubt about their not being the same species.

A male specimen of this species, that seemed to represent the extreme in its large size, was found in the entomological collections of the Kansas State Agricultural College, bearing a simple label marked "Tex." This specimen was compared with the cotypes of *S. robustus* Ball, and although it presented no essential specific differences, it was thought that it might represent Fowler's *cockerelli*. The genitalia were found to be identical with those of a cotype specimen of *robustus*. A drawing of the lateral view of the genitalia was prepared and sent, together with the specimen, to Mr. China, of the British Museum. Mr. China was kind enough to relax the type of *cockerelli* and to prepare a drawing of its genitalia from the same view. The drawings are doubtless of the same species. The few dif-

ferences that exist are due to the fact that the type of *S. cockerelli* was not subjected to the same treatment in preparation for study as had been used with the specimen from Texas. Mr. China very carefully compared the two specimens and summarized his findings. The differences that he found are immaterial, for the most part, since the present studies have shown that such can be expected to be found within the species. The following statements taken from his letter are important and worthy of record: "Genitalia very similar to those of *S. cockerelli*, but there are slight differences in the parameres. . . . In coloring the two specimens are almost identical." *S. cockerelli* then is a synonym of *S. robustus*.

Scolops fumidus (Uhler) exists in both the macropterous and brachypterous forms. The brachypterous form is small and distinctly oval in appearance, while the macropterous form is larger, with very long and widely flaring wings. It is evident from Uhler's description that he had only brachypterous males before him while writing. Van Duzee's *piceus* must be a macropterous female of Uhler's *fumidus*. There is so much difference in the size that the mistake was natural. Both brachypterous and macropterous specimens are before the writer. That both are the same species there is no doubt. The macropterous female fits Van Duzee's description, and the brachyterous male fits Uhler's description, and both will fit either description very well. *S. piceus* Van Duzee then is a synonym of *S. fumidus* (Uhler).

As a result of these studies the following species new to science have been added to the genus: *S. pruinosus* sp. n., *S. snowi* sp. n., *S. austrinus* sp. n., *S. luridus* sp. n., *S. immanis* sp. n., *S. flavidus* sp. n., *S. stonei* sp. n., and *S. flavidus* var. *pellos* var. n.

These studies have also established the following synonymy: *S. parvulus* Metcalf = *S. desiccatus* Uhler = *S. spurcus* Uhler = *S. pungens* Germar; *S. cockerelli* Fowler = *S. robustus* Ball; and *S. piceus* Van Duzee = *S. fumidus* Uhler.

KEY TO THE SUBGENERA OF THE GENUS *SCOLOPS*.

PAGE

A. Fore and middle tibiæ not foliaceous, not broader than those of hind legs. Vertex and pronotum in same plane. Eyes approximating pronotum.....*Scolops* Schaum, 429

AA. Fore and middle tibiæ foliaceous. Vertex above plane of pronotum. Eyes distant from pronotum.....*Belonocharis* Uhler, 448

SYSTEMATIC TREATMENT OF THE SUBGENUS *SCOLOPS*.

KEY TO THE GENUS *SCOLOPS*.

NOTE.—*Cephalic process long;* as long as front or longer. *Cephalic process stout;* three-fourths as wide as vertex or wider when measured at sulcus.

PAGE

A. Costa and costal cell of elytra with fuscous markings.
  B. Veins of corium concolorous.
    C. Elytra with numerous cross-veins apically.
      D. Longitudinal veins margined with narrow, dark bands; cross-veins strong, numerous; cephalic process slender.....*S. sulcipes* Say, 443
      DD. Longitudinal veins margined with fuscous dots in pairs; cross-veins weak, less numerous; cephalic process stout, *S. osborni* Ball, 442
    CC. Elytra without numerous cross-veins apically.
      E. Cephalic process slender, less than half as wide as vertex when measured at sulcus; fore and middle tibiæ twice banded with blackish-fuscous.....*S. austrinus* sp. n., 437
      EE. Cephalic process stout, three-fourths as wide as vertex when measured at sulcus; fore and middle tibiæ not banded with fuscous .....*S. vanduzei* Ball, 439
  BB. Veins of corium not concolorous.
    F. Cephalic process long; form not robust.
      G. Cephalic process about one-half as wide as vertex, sides parallel; form elongate-oval; color brownish .....*S. perdix* Uhler, 431
      GG. Cephalic process about three-fourths as wide as vertex, sides divergingly curved posteriorly; form broadly oval; color greyish-testaceous to blackish. *S. pungens* Germar, 438
    FF. Cephalic process short; form robust.
      H. Median carina of front ending at sulcus; process not rugose, not inflated anteriorly.
        I. Cephalic process stout, as broad as vertex when measured at sulcus, curved upward, sides converging anteriorly; color yellowish.....*S. hesperius* Uhler, 439
        II. Cephalic process slender, less than three-fourths as wide as vertex when measured at sulcus, straight sides, nearly parallel; color fuscous. *S. robustus* Ball, 434
      HH. Median carnia of front continuing on process to tip; process rugose, inflated anteriorly.
        J. Veins of elytra prominently marked with blackish-fuscous; color, a rich brown .....*S. grossus* Uhler., 445
        JJ. Veins of elytra nearly concolorous, sometimes faintly marked with small whitish points; color, pale brownish to straw yellowish. *S. immanis* sp. n., 447

AA. Costa and costal cell broadly whitish, unmarked.
  B. Veins of elytra concolorous.
    C. Cephalic process long and stout, as wide as vertex when measured at sulcus.
      D. Process inflated anteriorly; longitudinal veins of elytra margined with faint fuscous bands.....*S. luridus* sp. n., 440
      DD. Sides of process converging anteriorly; longitudinal veins of elytra not margined with fuscous bands.....*S. flavidus* sp. n., 441

PAGE

CC. Cephalic process short and stout, not as wide as vertex when measured at sulcus.

E. Elytra covered with a silvery pruinosity; color light straw-yellow, faintly marked with fuscous.....*S. pruinosus* sp. n., 435

EE. Elytra, a dark reddish-brown; body pale yellowish, unmarked; process of male very short and stout, that of female as in typical *S. flavidus*.....*S. flavidus* var. *pellos* var. n., 442

BB. Veins of elytra not concolorous.

F. Cephalic process long.

G. Process slender, about two-thirds as wide as vertex when measured at sulcus, sides strictly parallel.

H. Costa, the forks of cubitus, and the first anal vein broadly white, unmarked; form robust .....*S. uhleri* Ball, 444

HH. Excepting costa, all veins of elytra marked alike with brownish-fuscous throughout; elongate-oval .....*S. stonei* sp. n., 432

GG. Process stout, three-fourths as wide as vertex when measured at sulcus, sides not parallel.

I. Process parallel-margined, often slightly inflated at tip, elytra maculate with blackish-fuscous and white. *S. maculosus* Ball, 446

II. Process tapering anteriorly, elytra reddish brown .....*S. snowi* sp. n., 433

FF. Cephalic process short.

J. Color, light green; veins of elytra darker, alternately interrupted with whitish; costa paler, greenish. *S. viridis* Ball, 436

JJ. Color dark reddish-fuscous; veins of elytra irregularly marked with fuscous; costa conspicuously broadly white, *S. angustatus* Uhler, 430

Scolops angustatus Uhler.

(Pl. LXIII, Figs. 6, 6a.)

Uhler. Bul. U. S. Geol. Geog. Surv.: I, p. 350; 1876.

Cephalic process very short, very slender; form elongate-oval; color a dark, rich, reddish brown; costa broadly white, unmarked.

STRUCTURAL CHARACTERISTICS. Head not constricted behind eyes. Cephalic process short and slender, straight, shorter than front in ratio of seven to ten, narrower than vertex in ratio of one to three, sides parallel; tip truncate, polished. Vertex broad, somewhat convex, polished; caudal margin somewhat carinate at extremities, median carina obsolete; lateral margins prominently carinate, convergingly curved till over sulcus, then continuing on process parallel to tip. Margins of front straight, converging anteriorly, abruptly constricted to sulcus, then continuing on process parallel to tip; three carinæ of front equally prominent, median carina ending at sulcus. Lateral margins of pronotum carinate, straight; submarginal carinæ becoming obsolete anteriorly; caudal margin very broadly arcuated anteriorly, incised at center; central disc broader than long in ratio of four to three; lateral margins carinate, very broadly arcuated laterally, convergingly curved anteriorly; median carina prominent. Scutellum broader than long in ratio of nine to seven; lateral

margins of central disc carinate, median carina faintly indicated. Cubitus and media forking unequally, both well removed apically from junction of second and third anal veins, median further back.

COLOR CHARACTERISTICS. Beneath, orange yellow, more or less uniformly infuscated; above, a rich, reddish brown. Vertex shining, a pair of blackish-fuscous spots anteriorly. Front and ventral compartments of process pale yellowish, lateral compartments of front irrorate with fuscous. Process dark brown laterally and dorsally, latero-dorsal carinæ lightly yellowish. Pronotum lightly guttate with fuscous; a transverse series of six blackish-fuscous spots broadly arcuated anteriorly. A piceous-black spot between ventral extremity of postocular process and eye, none behind antenna, but another ventrad of center of epipleura. Scutellum guttate with fuscous, a pair of blackish indented points near apex of disc. Tegulæ clouded with fuscous. Elytra usually a rich brown; veins lighter, interrupted with fuscous; costa broadly white, unmarked; a light area along the proximal branches of cubitus and media apically; radial cell darker.

LENGTH. From sulcus to tip of telson, male and female 6 mm.; process, 1 to 1.3 mm.; greatest width, 2.6 to 3 mm.

Specimens are before the writer from many parts of the United States.

LOCALITY RECORDS. *British Columbia,* Colorado, Connecticut, Dakotas, District of Columbia, Florida, Georgia, Iowa, Indiana, *Kansas,* Louisiana, Maryland, Massachusetts, Minnesota, *Montana,* Nebraska, New Jersey, New York, Ohio, *Oregon.* The names in italics are additional to those listed by Van Duzee.*

Scolops perdix Uhler.

(Pl. LXIII, Figs. 7, 7a.)

Uhler. Trans. Md. Acad. Sci.: I, p. 405; 1900.

Cephalic process long, very slender, straight; form elongate, elytra narrow, nearly parallel-sided; general color dark greyish-testaceous.

STRUCTURAL CHARACTERISTICS. Head not constricted behind eyes. Cephalic process long and slender, as long as front, a little less than half as wide as vertex when measure at sulcus, parallel-margined. Vertex convex, shining; median carina wanting; caudal margin faintly carinate, straight; lateral margins carinate, prominent, straight, nearly parallel, abruptly converging till over sulcus, then continuing on process parallel to tip. Lateral margins of front carinate, straight, nearly parallel, abruptly constricted to sulcus and continuing on process parallel to tip; five carinæ of front equally prominent, three middle carinæ becoming obsolete before sulcus. Lateral margins of pronotum carinate, straight; submarginal carinæ becoming obsolete anteriorly; caudal margin narrowly arcuated anteriorly, incised at center; central disc as broad as long; lateral margins carinate, nearly parallel, sinuate mesad near centers, convergingly rounded anteriorly; median carina present, acute. Scutellum broader than long in ratio of four to five, margins of central disc carinate, median carina indicated. Cubitus and media branching unequally, cubitus near junction of second and third anal veins, media farther back toward apex.

COLOR CHARACTERISTICS. Greyish-testaceous, darkly infuscated; elytra grey-

* Van Duzee, E. P. Catalog of The Hemiptera: II Homoptera.

ish-hyaline, veins whitish, sparingly marked with large blackish-fuscous spots, costal cell broadly whitish, but always a few fuscous spots on costa. Wings smoky to hyaline, veins darker. Beneath greyish-testaceous, guttate with brownish; fore and middle tibiæ twice banded with brownish. Vertex shining, a dark crescentric spot anteriorly, interrupted in center. Front and lateral compartments of process pale yellowish, immaculate. Sides of pronotum irrorate with blackish fuscous, a piceous-black indented spot each side of median carina on central disc. Scutellum guttate with blackish-fuscous laterally, a pair of piceous-black indented points apically. Tegulæ darkly clouded with fuscous. A large piceous-black spot between ventral extremity of postocular process and eye, another behind each antenna, prolonged to postocular process, and a third ventrad of center of epipleura.

LENGTH. From sulcus to tip of telson, male and female 5.6 mm.; process, 1.6 to 2 mm.; greatest width 2.6 mm.

LOCALITY RECORDS. Arizona, Colorado, District of Columbia, *Florida, Illinois, Kansas,* Maryland, Massachusetts, *Mississippi,* New Jersey, New York, North Carolina, South Carolina, *Virginia.* A fine series of specimens were present on which to base the redescription. Italics indicates those locality records not listed by Van Duzee. The Arizona record is questionable and perhaps comes from the fact that *S. snowi* sp. n. has been called *S. perdix* Uhler.

Scolops stonei sp. n.

(Pl. LXIII, Figs. 8, 8a.)

In many respects resembling *S. uhleri* Ball, but much less robust, the elytra longer and narrower apically, which results in a more slender and apparently longer insect.

STRUCTURAL CHARACTERISTICS. Head not constricted behind eyes. Cephalic process long and slender, longer than front in ratio of seven to five, two-thirds as wide as vertex when measured at sulcus, nearly parallel-margined, straight; tip truncate, polished. Vertex convex, narrow, highly polished; caudal margin faintly carinate, straight; lateral margins carinate, broadly arcuated laterally over eyes, prominently sinuate in front of eyes, then continuing on process nearly parallel to tip. Margins of front subparallel, carinate, sinuate slightly mesad between eyes, constricted somewhat to sulcus, continuing on process diverging a little toward tip; five carinæ equally prominent, median carina ending at sulcus. Lateral margins of pronotum carinate, straight; submarginal carinæ becoming obsolete anteriorly; caudal margin prominently arcuated anteriorly, scarcely incised at center; central disc broader than long in ratio of seven to six; lateral margins carinate, straight, broadly converging anteriorly, median carina prominent. Scutellum broader than long in ratio of eight to seven, lateral margins of disc carinate, median carina nearly obsolete. Cubitus and media forking unequally, cubitus near junction of second and third anal veins, media well back toward apex.

COLOR CHARACTERISTICS. Greenish-white, heavily marked with blackish-fuscous. Vertex shining, a blackish-fuscous crescent anteriorly, interrupted in center. Front and ventral compartments of process pale, a little guttate with brownish; sides of process much darkened with blackish-fuscous, latero-dorsal

carinæ broadly whitish, a blackish-fuscous strip between. Sides of pronotum heavily guttate with blackish-fuscous, a large, round, piceous-black spot on central disc each side of median carina. Scutellum guttate with fuscous laterally; central disc mostly pale, a pair of blackish indented points near apex. Tegulæ darkly clouded with fuscous. Elytra heavily marked with blackish-fuscous; veins lighter, interrupted with blackish-fuscous points; costa broadly white, unmarked. A large, piceous-black spot between postocular process and eye, another behind each antenna prolonged to that between postocular process and eye, a third ventrad of center of epipleura represented only by indentation. Epipleuræ heavily and darkly infuscated. Beneath guttate with fuscous. Fore and middle tibiæ twice banded fuscous.

LENGTH. From sulcus to tip of telson, male 5.5 mm., female 6 mm.; process, male 2 mm., female 2.5 mm.; greatest width, male 2.3 mm., female 3 mm.

Described from 24 specimens—20 from Sanford, Fla., E. D. Ball; 2 from Biloxi, Miss., C. J. Drake; 1 from Wilmington, N. C., Osborn and Metcalf; and 1 from Georgia in the P. R. Uhler collection; 16 males and 8 females. Holotype, male; allotype and paratypes in the entomological collections of the University of Kansas, paratype No. 41,346 in the collections of the National Museum, paratype in the collection of Z. P. Metcalf, and paratypes in the collection of E. D. Ball.

Scolops snowi sp. n.

(Pl. LXIII, Figs. 9, 9a.)

Resembling *S. perdix* Uhler, but lighter and more robust, with a longer and stouter process; elytra dark, fusco-hyaline, veins obsoletely and sparingly interrupted with whitish; costal border broader and whiter, lacking the blackish-fuscous flecks found in that species.

STRUCTURAL CHARACTERISTICS. Head constricted behind eyes. Cephalic process long, slender, straight, five-sevenths as wide as vertex when measured at sulcus, longer than front in ratio of five to four, sides converging anteriorly; tip truncate, polished. Vertex somewhat convex; caudal margin carinate, straight; median carina nearly obsolete; lateral margins carinate, acute, arcuated laterally over eyes, sinuate in front of eyes, and continuing on process nearly parallel to tip. Margins of front converging anteriorly, sinuate mesad between eyes, abruptly constricted at sulcus, and continuing on process straight to tip; five carinæ equally prominent, median carina ending at sulcus. Lateral margins of pronotum carinate, slightly sinuate; submarginal carinæ bending back and joining lateral margins of disc near posterior end; caudal margin broadly arcuated anteriorly; central disc broader than long in ratio of four to three; lateral margins carinate, slightly sinuate mesad; median carina prominent. Scutellum broader than long in ratio of four to three; lateral margins of central disc carinate, median carina nearly obsolete. Cubitus and media forking unequally, cubitus near junction of second and third anal veins, media well back toward apex.

COLOR CHARACTERISTICS. Elytra dark, fusco-hyaline, veins obsoletely and sparingly interrupted with whitish, a large, blackish-fuscous spot just anterior to junction of cubitus and media, a row of blackish-fuscous spots on apical margins, costa broadly white, unmarked. Wings white to brownish, veins

darker. Beneath pale, yellowish-green, guttate with brownish; fore and middle tibiæ twice banded with brown. Vertex shining, a dark crescentric spot anteriorly, interrupted in center. Lateral compartments of front guttate with brownish, those of process uniformly dark brown; central compartments of front and process pale yellowish, immaculate. Sides of pronotum somewhat granulose, guttate with blackish-fuscous; a small black spot each side of median carina of central disc; another somewhat crescent-shaped, against each lateral margin on outer side next eye. Scuttellum guttate with brownish; a pair of small, blackish-fuscous points near apex. A prominent blackish-fuscous spot between ventral extremity of postocular process and eye, another behind each antenna prolonged to postocular process, and a third ventrad of center of epipleura.

LENGTH. From sulcus to tip of telson, male 5 mm., female 6 mm.; process, 1.7 mm.; greatest width, male 2.3 mm., female 3 mm.

Described from 8 specimens from southern Arizona, F. H. Snow; and 4 specimens from Logan canyon, Utah, 2 from Richfield, Utah, and 2 from Soldier, Utah, E. D. Ball; 10 males and 6 females. Holotype, male; allotype and paratypes deposited in the entomological collections of the University of Kansas; paratypes in the collection of E. D. Ball.

Scolops robustus Ball.

(Pl. LXIV, Figs. 1, 1a.)

Ball. Can. Ent.; XXXIV, p. 150; 1902.
Cockerelli Fowler. Biol. Centr. Am., Homop.: I, p. 122; 1904; *Ornithissus.*

Body distinctly broadly oval, of a grayish-testaceous color; cephalic process very short and slender, about half as long as front and not over half as wide as vertex when measured at sulcus, tapering slightly anteriorly, straight.

STRUCTURAL CHARACTERISTICS. Head not constricted behind eyes. Cephalic process short, slender, straight; sides nearly parallel, constricted at immediate tip; tip truncate, polished. Vertex very moderately convex, caudal margin not carinate, median carina obsolete; lateral margins carinate, acute, flattened laterally over eyes, abruptly constricted till over sulcus, then continuing on process nearly parallel to tip. Margins of front converging anteriorly, abruptly constricted to sulcus, continuing on process nearly parallel to tip; five carinæ of front equally prominent, median carina ending at sulcus. Lateral margins of pronotum carinate, broadly rounded, submarginal carinæ becoming obsolete anteriorly; caudal margin broadly arcuated anteriorly, very slightly incised at center; central disc broader than long in the ratio of four to three, lateral margins convergingly curved anteriorly, median carina prominent. Scutellum broader than long in ratio of five to three, lateral margins of central disc carinate, median carina usually obsolete or nearly so. Cubitus and media of corium usually forking equally near junction of second and third anal veins.

COLOR CHARACTERISTICS. Greyish-testaceous above and below, more or less guttate with brownish; elytra yellowish-hyaline, irregularly marked with fuscous blotches along veins; veins prominent, lighter, seldomly interrupted with blackish fuscous, conspicuously lighter anterior to forking of cubitus and media; costal vein and cell mostly whitish, basal half of costal cell suffused with brown toward base; wings whitish, diaphanous. Fore and middle tibiæ banded

with fuscous. Vertex shining, a pair of small blackish spots anteriorly. Process greenish or smoky, the carinæ pale. Lateral compartments of front and process guttate with brown which becomes denser and darker anteriorly, central compartments unmarked. Pronotum distinctly lighter, sides marked with blackish-fuscous spots, a large, round, pitch-black spot each side of median carina of central disc. Scutellum guttate with blackish-fuscous laterally, central disc pale yellowish, a pair of blackish indented points near apex. A small, round, blackish-fuscous spot between ventral extremity of postocular process and eye. Epipleura heavily guttate with blackish-fuscous.

LENGTH. From sulcus to tip of telson, male 4.3 to 4.6 mm., female 5.3 mm.; process, male 1 mm., female 1.15 mm.; greatest width, male 2.3 mm., female 2.6 mm.

The writer had before him specimens from Arizona, Colorado, Kansas, Nebraska, Texas and Utah. To this list must be added Mexico, the type locality of Fowler's *cockerelli*. The only locality record listed by Van Duzee for Ball's *robustus* is Colorado. The series of specimens used in writing this description contained 6 cotype specimens of *S. robustus* Ball. Elsewhere in this paper the synonymy of these species has been adequately discussed.

Scolops pruinosus sp. n.

(Pl. LXIV, Figs. 2, 2a.)

Resembling *S. robustus* Ball in form and somewhat in appearance, but larger and lighter, with a longer and stouter process, and covered with a distinct pruinosity that persists.

STRUCTURAL CHARACTERISTICS. Head somewhat constricted behind eyes. Cephalic process short and stout, three-fourths as wide as vertex when measured at sulcus, shorter than front in ratio of eight to eleven, and tapering but slightly to tip; tip truncate, transversely carinate on dorsal margin. Vertex slightly convex, shining; caudal margin straight, slightly carinate; median carina present, obtuse, sometimes appearing to extend as faint light line on process; lateral margins carinate, prominent, slightly arcuated laterally over eyes, sinuate in front of eyes, and continuing on process nearly parallel tip to tip; tip transversely carinate on dorsal margin. Margins of front subparallel, carinate, abruptly constricted to sulcus; five carinæ equally prominent, median carina fading out at sulcus. Lateral margins of pronotum carinate, straight; submarginal carinæ bending back to lateral margins of disc at centers; caudal margin broadly arcuated anteriorly; central disc broader than long in ratio of four to three, lateral margins carinate, arcuated laterally, median carina prominent. Scutellum broader than long in ratio of five to three; margins of central disc carinate, median carina present. Cubitus and media forking about equally near junction of second and third anal veins, $media_{1+2}$ forking again before apex.

COLOR CHARACTERISTICS. Light straw yellow, faintly guttate with fuscous, elytra covered with a silvery pruinosity; the large, round, pitch-black spots on disc of pronotum conspicuous; beneath, pale, guttage with faint brownish. Vertex shining, a blackish-fuscous spot each side of median carina anteriorly. Lateral compartments of front and process made darker by irregular patches and spots of blackish-fuscous, which increases in density toward tip of process, making it much darker laterally and anteriorly. Central compartments of

process pale, immaculate. Sides of pronotum irregularly marked with blackish-fuscous; a large, round, piceous-black spot on central disc each side of median carina, another of irregular shape against each lateral margin on outer side next eye. A pair of black, indented points near apex of scutellum; sides of scutellum irregularly marked with blackish-fuscous. A prominent black spot between ventral extremity of postocular process and eye, another behind each antenna, and a third ventrad of center of epipleura. Veins of elytra concolorous, margined each side with faint, irregularly placed, fuscous spots, a row of fuscous dots on apical margin; costal border broadly white, unmarked. Fore and middle tibiæ faintly twice banded with fuscous.

LENGTH. From sulcus to tip of telson, male 5.3 mm., female 7 mm.; process 1.6 mm.; greatest width, male 2.6 mm., female 3.3 mm.

Described from 7 specimens taken at Wray and Julesburg, Colo., E. D. Ball; 2 males and 5 females. Holotype, male; allotype and paratypes deposited in the entomological collections of the University of Kansas, paratypes in the collection of E. D. Ball, and paratype in the collections of the Colorado State Agricultural College. The silvery pruinosity of this insect seems to be a unique character for the genus.

Scolops viridis Ball.

(Pl. LXIV, Figs. 3, 3a.)

Ball. Can. Ent.: XXXIV, p. 149; 1902.

Cephalic process long and very slender, parallel-margined; of much the same form as *S. perdix* Uhler, but larger; color light green, veins of elytra marked with pale smoky spots.

STRUCTURAL CHARACTERISTICS. Head not constricted behind eyes. Cephalic process long and slender, a little longer than front and not more than half as wide as vertex when measured at sulcus, parallel-margined, sometimes appearing a little inflated at tip; tip truncate, polished. Vertex broad, convex, polished; caudal margin faintly carinate, straight; lateral margins carinate, acute, nearly straight, subparallel, converging till over sulcus, then diverging a little and continuing on process parallel to tip. Margins of front nearly straight, subparallel, faintly carinate, abruptly constricted to sulcus and continuing on process nearly parallel to tip; three middle carinæ equally prominent, median carina ending at sulcus. Pronotum somewhat wrinkled, lateral margins faintly carinate, broadly rounded; submarginal carinæ becoming obsolete anteriorly; caudal margin broadly arcuated anteriorly, incised at center; central disc broader than long in ratio of four to three; lateral margins carinate, straight, converging a little anteriorly, median carina present, obtuse. Scutellum broader than long in ratio of four to three; lateral margins of central disc carinate, median carina only indicated. Cubitus and media usually forking about equally near junction of second and third anal veins.

COLOR CHARACTERISTICS. Light green, irrorate with smoky-fuscous; veins of elytra bright green, alternately interrupted with whitish and pale smoky-fuscous; costa very pale green, unmarked. A pair of black spots on disc of pronotum, another on scutellum apically. Wings whitish, diaphanous.

LENGTH. From sulcus to tip of telson, male 5 mm., female 5.6 mm.; process 1.6 to 2 mm.; greatest width 2.6 mm.

Description based on numerous specimens from Colorado and Utah, including 5 cotypes. The Utah record is additional to that listed by Van Duzee.

Scolops austrinus sp. n.

(Pl. LXIV, Figs. 4, 4a.)

Resembling S. *robustus* Ball somewhat in appearance, but lighter, and larger, with longer wings which results in a less globular appearance, and with a much longer process.

STRUCTURAL CHARACTERISTICS. Head constricted behind eyes. Cephalic process long, slender, less than half as wide as vertex measured at sulcus, as long as front, parallel-sided, and usually bent upward; tip truncate, polished. Vertex convex, broad, highly polished; caudal margin slightly carinate at extremities; median carina obsolete; lateral margins carinate, prominent, arcuated laterally over eyes, prominently sinuate in front of eyes, and continuing on process parallel to tip. Margins of front somewhat carinate, converging anteriorly, abruptly constricted to sulcus, continuing on process straight to tip; three carinæ of front equally prominent, median carina of front continuing beyond sulcus for a short distance. Lateral margins of pronotum carinate, straight; submarginal carinæ bending back toward lateral margins of central disc; caudal margin broadly arcuated anteriorly, incised at center; central disc as broad as long; lateral margins carinate, broadly converging anteriorly, median carina prominent. Scutellum broader than long in ratio of five to three; central disc flat, lateral margins somewhat carinate, median carina absent. Cubitus and media forking somewhat unequally near junction of second and third anal veins, media before cubitus.

COLOR CHARACTERISTICS. Pale straw yellow or tarnished ivory, lightly guttate with brownish and sparingly marked with blackish-fuscous. Vertex glossy, a blackish-fuscous spot anteriorly, usually interrupted in center. Front and ventral compartments of process pale, nearly immaculate; lateroventral carinæ of process dark, broadly bordered with blackish-fuscous; latero-dorsal carinæ broadly light, a blackish-fuscous strip between. Sides of pronotum heavily marked with blackish-fuscous; a large, round, piceous-black spot on central disc each side of median carina. Scutellum guttate with fuscous laterally; central disc pale, unmarked, except for pair of blackish indented points near apex. Tegulæ clouded with fuscous. A large, piceous-black spot between postocular process and eye, another behind each antenna, prolonged to dark markings on pronotum, a third that varies in prominence ventrad in center of epipleura. Veins of elytra lighter, concolorous, usually margined each side with minute fuscous spots; apical areoles heavily marked with brownish. Wings fusco-diaphanous, veins lighter. Fore and middle tibiæ heavily twice banded with blackish-fuscous.

LENGTH. From sulcus to tip of telson, male 5 mm., female 6 mm.; process, male 1.15 mm., female 1.3 mm.; greatest width, male 2.6 mm., female 3 mm.

Described from 5 specimens from Tucson, Ariz., F. H. Snow; 2 from Tucson, Ariz., C. N. Ainslie, in the collection of Herbert Osborn; and 9 from Nogales, Ariz., F. W. Nunenmacher, in the collection of W. J. Gerhard; 8 males and 8 females. Holotype, male; allotype and paratypes deposited in the entomological collections of the University of Kansas. Paratypes in the collections of Herbert Osborn and W. J. Gerhard.

Scolops pungens (Germar).

(Pl. LXIV, Figs. 5, 5a.)

Germar. Thon's Ent. Archiv.: II, p. 47; 1830; *Flata.*
Spurcus Uhler. Trans. Md. Acad. Sci.: I, p. 403; 1900.
Desiccatus Uhler. Trans. Md. Acad. Sci.: I, p. 407; 1900.
Parvulus Metcalf. Jl. Elisha Mitchell Sci. Soc.; XXXVIII, p. 175; 1923.

Brachypterous form broadly oval; macropterous form elongate, elytra nearly parallel-margined, flaring posteriorly; process long, stout, upturned; color, dull, smoky-whitish to greyish-testaceous, evenly peppered with dark fuscous points.

STRUCTURAL CHARACTERISTICS. Head not constricted behind eyes. Cephalic process long, usually longer than front in ratio of six to five, stout, not more than three-fourths as wide as vertex when measured at sulcus, upturned, tapering gently toward tip. Vertex convex, shining; caudal margin not carinate; lateral margins carinate, prominent, arcuated laterally over eyes, sinuate in front of eyes, diverging till over sulcus, then converging again and continuing on process subparallel to tip; tip truncate, polished, transversely carinate on dorsal margin. Margins of front nearly straight, converging anteriorly, abruptly constricted to sulcus and continuing on process converging a little to tip; five carinæ of front equally prominent, median carina ending at sulcus. Lateral margins of pronotum carinate, broadly rounding anteriorly; submarginal carinæ becoming obsolete anteriorly; caudal margin broadly arcuated anteriorly, incised at center; central disc broader than long in ratio of four to three; lateral margins carinate, converging rapidly anteriorly; median carina present, prominent. Scutellum broader than long in ratio of four to three; lateral margins of central disc usually carinate, median carina sometimes present, usually indicated. Cubitus and media branching about equally near junction of second and third anal veins, media usually a little anterior to cubitus.

COLOR CHARACTERISTICS. Dull, smoky-whitish to greyish-testaceous, fresh specimens often showing greenish, evenly peppered above and below with minute, dark, fuscous flecks, which vary greatly in density, causing some specimens to appear almost black, others a solid yellow. Veins of elytra saddled with small fuscous markings of even distribution. Vertex shining, infuscated anteriorly, sometimes entirely darkened. Brownish marks on pronotum increase in density laterally resulting in piceous-black callosities behind eyes. All geminate indentations present, pitch-black.

LENGTH. From sulcus to tip of telson, male 4.6 to 6 mm., female 5.3 to 6.3 mm.; process, male 1.15 to 2 mm., female 1.6 to 2.3 mm.; greatest width, male 2.3 to 3 mm., female 2.6 to 3.3 mm.

The above description is based on a very long series of specimens from various parts of the United States and Mexico. The Mexican record consists in a specimen taken at Monterey, Mexico, in the entomological collections of the Illinois Natural History Survey. The synonymy of this species has been adequately discussed elsewhere.

LOCALITY RECORDS. *Colorado,* District of Columbia, Florida, *Illinois,* Indiana, *Iowa,* Kansas, *Kentucky, Louisiana,* Maryland, *Mexico, Mississippi,* Missouri, *Nebraska,* New Jersey, North Carolina, *North Dakota,* Ohio, *Pennsylvania, South Carolina,* Texas, *Wisconsin.* Italics indicates locality records not listed by Van Duzee.

Scolops hesperius Uhler.

(Pl. LXIV, Figs. 6, 6a.)

Uhler. Bul. U. S. Geol. Geog. Surv.: I, p. 349; 1876.

Cephalic process short and very stout, tapering anteriorly, bent upward; form robust; color pale yellowish, veins of elytra dotted with fuscous.

STRUCTURAL CHARACTERISTICS. Head not constricted behind eyes. Cephalic process short and stout, shorter than front and as wide, or wider, than vertex when measured at sulcus. Vertex scarcely convex, slightly wrinkled, median carina sometimes indicated; caudal margin faintly carinate, arcuated a little anteriorly; lateral margins prominently carinate, nearly straight, continuing on process converging to tip. Lateral margins of front nearly straight, carinate, sinuate a little mesad between eyes, subparallel, constricted a little to sulcus, continuing on process converging a little toward tip; three median carinæ of front equally prominent, median carina ending at sulcus. Pronotum granulose; lateral margins carinate, broadly rounded; submarginal carinæ becoming obsolete anteriorly; caudal margin broadly arcuated anteriorly, incised at center; central disc as broad as long; lateral margins carinate, nearly straight, sinuate a little mesad, converging anteriorly; median carina present, acute. Scutellum smooth, broader than long in ratio of three to two, lateral margins carinate, median carina usually indicated. Cubitus and media forking equally near junction of second and third anal veins.

COLOR CHARACTERISTICS. Pale yellowish, more or less tinged with fuscous; geminate indentations present, but uncolored; front and process pale yellowish, sometimes yellowish-green, unmarked; eyes usually reddish; legs longitudinally striped with fuscous; pronotum and scutellum somewhat guttate with fuscous; veins of elytra dotted and spotted with fuscous; wings white.

LENGTH. From sulcus to tip of telson, male 6 mm., female 6.6 mm.; process, 1.6 mm.; greatest width, 3 mm.

In describing this species specimens have been examined from California, Colorado, *Kansas, Montana, North Dakota, South Dakota,* and Texas. In addition to this list Van Duzee adds Idaho. Italics indicate locality records not listed by Van Duzee.

Scolops vanduzei Ball.

(Pl. LXIV, Figs. 7, 7a.)

Ball. Can. Ent.: XXXIV, p. 150; 1902.

Cephalic process long and very stout, bent upward; form broadly oval; color yellowish-testaceous, veins of elytra light, margined each side with narrow nearly continuous fuscous stripes.

STRUCTURAL CHARACTERISTICS. Head not constricted behind eyes. Cephalic process long and stout, as long as front and very nearly as wide as vertex when measured at sulcus. Vertex convex; median carina present, obtuse; caudal margin slightly carinate, straight; lateral margins carinate, acute, arcuated laterally over eyes and continuing on process converging a little toward tip; tip truncate, transversely carinate on dorsal margin. Lateral margins of front carinate, subparallel, constricted a little to sulcus, then continuing on process parallel to tip, abruptly converged at immediate tip; five carinæ of front equally prominent; median carina continuing on process to tip, faint. Pro-

notum a little granulose; lateral margins carinate, broadly rounded; submarginal carinæ bending back to lateral margins of central disc caudad of centers; caudal margin broadly arcuated anteriorly, incised at center; central disc broader than long in ratio of four to three, lateral margins carinate, nearly straight, converging anteriorly; median carina present, acute. Scutellum broader than long in ratio of four to three; margins of central disc carinate, median carina only indicated. Cubitus and media forking unequally cubitus near junction of second and third anal veins, media usually a little farther back on corium.

COLOR CHARACTERISTICS. Yellowish-testaceous, a little guttate with fuscous. Vertex shining, a piceous-black crescentic spot anteriorly; a pair of small deeply indented points, piceous-black, in color, on disc of pronotum, another on scutellum apically. A piceous-black spot between postocular process and eye, another behind each antenna, minute, and a third ventrad of center of epipleura. Front pale yellowish, immaculate; lateral compartments of process guttate with blackish-fuscous which increases in density anteriorly. Legs longitudinally striped with fuscous. Veins of elytra concolorous, margined each side with narrow, nearly continuous stripes. Wings white, diaphanous.

LENGTH. From sulcus to tip of telson, male 5 mm., female 6 mm.; process, 1.6 mm.; greatest width, 2.6 mm.

Description based on specimens from *Colorado* and Nebraska, including 4 cotypes. A specimen from Colorado is unusually dark due to an increase in the density of the fuscous markings. The Colorado record is an addition to the record given by Van Duzee.

Scolops luridus sp. n.

(Pl. LXV, Figs. 1, 1a.)

Resembling *S. hesperius* Uhler somewhat in form and appearance, but lighter and larger, distinctly lurid, nearly concolorous, a few dark markings in apical areas of elytra, and with a longer and stouter process.

STRUCTURAL CHARACTERISTICS. Head not constricted behind eyes. Cephalic process long, as long as front, and as wide as vertex when measured at sulcus, straight, appearing somewhat inflated; tip truncate, polished. Vertex very slightly convex, finely wrinkled; caudal margin straight, carinate; median carinate; median carina present, obtuse; lateral margins carinate, acute, very slightly arcuated laterally over eyes, sinuate in front of eyes, and continuing on process nearly parallel to tip. Margins of front somewhat carinate, nearly parallel, constricted somewhat to sulcus, diverging anteriorly on process and converging again near tip, producing an inflated appearance; three carinæ equally prominent; median carina continuing on process nearly to tip. Lateral margins of pronotum somewhat carinate, straight; submarginal carinæ bending back and joining lateral margins of central disc caudad of center; caudal margin narrowly arcuated anteriorly, incised at center; central disc nearly as broad as long; lateral margins carinate, nearly parallel, convergingly rounded anteriorly; median carina prominent. Scutellum broader than long in ratio of three to two; margins of central disc carinate, median carina nearly obsolete. Cubitus and media forking about equally near junction of second and third anal veins.

COLOR CHARACTERISTICS. Brightly lurid above and below, very nearly con-

colorous, often with reddish or greenish casts, eyes distinctly reddish, veins of elytra concolorous, fuscous areas limited to faint, narrow bands bordering longitudinal veins and to apical areoles. Costa broadly white, unmarked. Wings smoky; veins dark, bordered with white.

LENGTH. From sulcus to tip of telson, male 6 mm., female 7 mm.; process, male 1.6 mm., female 2 mm.; greatest width, male 3 mm., female 3.3 mm.

Described from 18 specimens mostly from Sumner county, Kansas, E. P. Breakey; and 2 from Riley county, Kansas, G. A. Dean; 14 males and 6 females. Holotype, male; allotype and paratypes deposited in the entomological collections of the University of Kansas, and paratypes in the entomological collections of the Kansas State Agricultural College. The nearly concolorous appearance of this species together with its lurid color, its large size, and inflated appearance of its process, ought to aid materially in its determination.

Scolops flavidus sp. n.

(Pl. LXV, Figs. 2, 2a.)

Of much the same appearance as *S. luridus* Breakey, but smaller and lighter, with a long and stout process that tapers rapidly to the tip, giving it a pointed appearance.

STRUCTURAL CHARACTERISTICS. Head not constricted behind eyes. Cephalic process long and stout, longer than front in ratio of six to five, three-fourths as wide as vertex when measured at sulcus, straight, sides converging rapidly to tip; tip narrowed almost to vertical, obtuse carina. Vertex nearly flat, very finely wrinkled; caudal margin straight, somewhat carinate; median carina scarcely visible; lateral margins carinate, acute, nearly straight, converging slightly anteriorly, flattened laterally over eyes, and continuing on process straight to tip. Margins of front carinate, nearly straight, constricted somewhat beyond sulcus, and continuing on process as rapidly converging, straight lines to tip; submarginal carinæ paralleling those of margins to sulcus, then diverging somewhat to tip; median carina becoming obsolete on process. Lateral margins of pronotum somewhat carinate, straight; submarginal carinæ becoming obsolete anteriorly; caudal margin broadly arcuated anteriorly, incised at center; central disc broader than long in ratio of four to three; lateral margins carinate, nearly straight, broadly converging anteriorly, often slightly sinuate mesad in posterior half; a carina originating from each at this point, projecting mesad, and becoming obsolete near median keel. Scutellum broader than long in ratio of five to three; margins of central disc carinate, median carina nearly obsolete. Cubitus and media forking unequally, the points of branching forming an oblique line across corium with junction of the second and third anal veins.

COLOR CHARACTERISTICS. Pale yellow, almost completely devoid of darker markings. The most nearly concolorous species yet known for the genus. Some specimens with a fuscous cloud near the origin of media and cubitus.

LENGTH. From sulcus to tip of telson, male 5.3 mm., female 6.3 mm.; process, male 1.6 mm., female 2 mm.; greatest width, male 3 mm., female 3.6 mm.

Described from 7 specimens from Eugene, Oregon, J. A. Hyslop, 4 males and 3 females, in the collection of Herbert Osborn. Allotype and paratypes in the entomological collections of the University of Kansas.

Scolops flavidus var. *pellos* var. n.

(Pl. LXV, Figs. 5, 5a.)

Resembling *S. flavidus* Breakey somewhat in form, but smaller, and in general appearance darker, the pale yellowish body presenting a marked contrast to the dark, reddish-brown elytra.

STRUCTURAL CHARACTERISTICS. Head not constricted behind eyes. Cephalic process of male short, shorter than front in ratio of two to three, stout, three-fourths as wide as vertex when measured at sulcus, straight; that of female long, longer than front in ratio of five to three; stout, very nearly as wide as vertex when measured at sulcus, straight. Vertex nearly flat; caudal margin carinate, straight; median carina present, obtuse, continuing on process as light line; lateral margins carinate, acute, nearly straight, sinuate in front of eyes, continuing on process straight to tip, converging at immediate tip; tip truncate, polished. Margins of front nearly straight, carinate, subparallel, somewhat sinuate between eyes, constricted slightly to sulcus, and continuing on process nearly parallel to tip. Lateral margins of pronotum somewhat carinate, broadly rounded, submarginal carinæ becoming obsolete anteriorly; caudal margin broadly arcuated anteriorly, and incised at center. Central disc very nearly as broad as long; lateral margins carinate, sinuate mesad in posterior half, a carina originating from each at this point, projecting mesad, and becoming obsolete near median keel. Scutellum broader than long in ratio of four to three, margins of central disc carinate, median carina nearly obsolete. Cubitus and media forking unequally, cubitus near junction of second and third anal veins, media farther back on corium.

COLOR CHARACTERISTICS. Body mostly of a bright, pale straw yellow; elytra of a bright, nearly uniform, reddish-brown; costa broadly yellowish-white, unmarked. Lateral and dorsal surfaces of process stained with reddish-brown which increases in density anteriorly. Legs somewhat stained with reddish-brown. Wings uniformly whitish, diaphanous.

LENGTH. From sulcus to tip of telson, male 4.6 mm., female 5.3 mm.; process, male 1 mm., female 2 mm.; greatest width, male 2.6 mm., female 3 mm.

Described from two specimens from Eugene, Ore., J. A. Hyslop, in the collection of Herbert Osborn. Holotype, male; holotype in the collection of Herbert Osborn, allotype in the entomological collections of the University of Kansas. The reddish-brown elytra of this insect on the bright, yellowish body, together with the marked structural differences in the process of the sexes, should aid materially in its determination.

Scolops osborni Ball.

(Pl. LXV, Figs. 4, 4a.)

Ball. Can. Ent.: XXXIV, p. 147; 1902.

Largest species of the genus; form broadly oval; color very pale yellowish; cephalic process very long and stout, bent upward, and tapering anteriorly to a thick point.

STRUCTURAL CHARACTERISTICS. Head constricted behind eyes. Cephalic process long and stout, a little longer than front, as wide as vertex when measured at sulcus, and regularly tapering anteriorly. Vertex convex, slightly

wrinkled, median carina present, obtuse; caudal margin carinate straight; lateral margins carinate, prominent, arcuated a little laterally over eyes, continuing on process converging to tip. Lateral margins of front straight, subparallel, constricted a little to sulcus and continuing on process, converging a little toward tip. Lateral margins of pronotum carinate, slightly sinuate mesad; submarginal carinæ becoming obsolete anteriorly; caudal margin broadly arcuated anteriorly, incised at center; central disc as broad as long, lateral margins carinate, sinuate mesad at centers, broadly rounding anteriorly, median carina present, acute. Scutellum broader than long in ratio of three to two; lateral margins of central disc carinate, carinæ abruptly bent mesad and united anteriorly; median carina wanting. Veins of elytra doubly furcate, reticulations numerous apically.

COLOR CHARACTERISTICS. Elytra pale yellowish, veins concolorous, margined each side with regularly placed pairs of fuscous dots. Wings whitish, veins darker. Beneath yellowish, heavily infuscated. Fore and middle tibiæ twice banded with blackish-fuscous. Front and process yellow, nearly immaculate; pronotum and scutellum yellowish, tinged with green, lightly infuscated; a large pitch-black spot behind each eye of nearly same diameter as eye, a transverse series of four small pitch-black spots on scutellum, arcuated posteriorly. Tegulæ infuscated.

LENGTH. From sulcus to tip of telson, male 7 mm., female 10 mm.; process, 2.3 mm.; greatest width, 3.3 to 3.6 mm.

Description based on a fine series of specimens from Kansas and *Nebraska*. In his original description of the species Ball records Ohio as a locality record. The Nebraska record is an addition to the records given by Van Duzee.

Scolops sulcipes (Say).

(Pl. LXV, Figs. 3, 3a.)

Say. Jl. Acad. Nat. Sci. Phila.: IV, p. 335; 1825; *Fulgora*.

Cephalic process very long, upturned, tapering to a slender point; elytra densely reticulated apically; color grayish-testaceous to reddish-brown; veins of elytra lighter, margined each side with blackish-fuscous bands.

STRUCTURAL CHARACTERISTICS. Head constricted behind eyes. Cephalic process long, longer than front in ratio of five to seven, nearly as wide as vertex when measured at sulcus, sides nearly straight and converging anteriorly to a slender point. Margins of front carinate, usually straight, subparallel; five carinæ of front equally prominent, median carina ending at sulcus. Vertex scarcely convex, shining; caudal margin faintly carinate at extremities; lateral margins carinate, straight, converging anteriorly and continuing on process nearly straight to tip. Lateral margins of pronotum carinate, broadly rounded anteriorly; submarginal carinæ becoming obsolete anteriorly; caudal margin arcuated narrowly anteriorly, incised at center; central disc narrow, a little more than three-fourths as broad as long, lateral margins carinate, nearly parallel, sinuate mesad near centers; median carina present, acute. Scutellum broader than long in ratio of five to three, margins of central disc carinate, median carina only indicated. Brachypterous form broadly oval; macropterous form elongate-oval, elytra nearly parallel-margined, flaring posteriorly.

COLOR CHARACTERISTICS. Heavily infuscated above and below. Cephalic

process blackish-fuscous, carinæ pale yellowish. A pair of blackish-fuscous points on vertex anteriorly, another on disc of pronotum, and a third apically on disc of scutellum. A large piceous-black callosity behind each eye, and a smaller one behind each antenna; piceous-black spots between postocular processes and eyes and ventrad of centers of epipleuræ. Fore and middle tibiæ twice banded with blackish-fuscous. Veins of elytra concolorous, margined each side with blackish-fuscous bands.

LENGTH. From sulcus to tip of telson, male 4.6 to 6 mm., female 6-7 mm., process, 1.6 to 2 mm.; greatest width, male 2.6 to 3 mm., female 3-4 mm.

The above description is based on a very long series of specimens from the United States and Canada.

LOCALITY RECORDS. Arizona, *British Columbia,* Colorado, Connecticut, *District of Columbia,* Florida, Illinois, Iowa, Kansas, Manitoba, Maine, Maryland, Minnesota, Missouri, Nebraska, New Jersey, New York, New Mexico, North Carolina, North Dakota, Ohio, Ontario, *Oregon,* Pennsylvania, Quebec, Rhode Island, Texas, Utah, *Vermont,* Washington, *Wisconsin.* Italics indicate locality records not listed by Van Duzee.

Scolops uhleri Ball.

(Pl. LXV, Figs. 6, 6a.)

Ball. Can Ent.: XXXIV, p. 148; 1902.

Cephalic process very long, nearly half longer than front, parallel-margined, about half as wide as vertex when measured at sulcus; form robust; elytra short, broadly rounded apically; general coloring dark brown, longitudinally marked with whitish bars on elytra.

STRUCTURAL CHARACTERISTICS. Head constricted behind eyes. Cephalic process long and slender, longer than front in ratio of seven to five, a little wider than vertex when measured at sulcus, parallel-margined; tip truncate, polished. Vertex convex, broad, highly polished; caudal margin not carinate; lateral margins crainate, arcuated laterally ever eyes, sinuate in front of eyes, continuing on process parallel to tip. Margins of front carinate, converging anteriorly, sinuate mesad between eyes, constricted somewhat to sulcus, continuing on process, diverging slightly toward tip, constricted at immediate tip; three carinæ of front equally prominent, median carina ending at sulcus.. Pronotum very short, very broadly arcuated anteriorly; lateral margins faintly carinate, straight; submarginal carinæ becoming absolete anteriorly; central disc broader than long in ratio of four to three; lateral margins carinate, converging anteriorly, sinuate mesad, broadly rounding anteriorly; median carina prominent. Scutellum broader than long in ratio of three to two, lateral margins of disc carinate, median carina obsolete. Elytra broadly rounded apically; cubitus and media forking unequally, both well removed apically from junction of second and third anal veins, media further back.

COLOR CHARACTERISTICS. Beneath, pale soiled yellow; above, darker, longitudinally marked with whitish bars. Vertex shining, a blackish-fuscous crescent anteriorly, interrupted in center. Front and ventral compartments of process pale yellowish, a little guttate with fuscous; sides of process much darkened with blackish-fuscous; latero-dorsal carinæ broadly whitish, a dark

strip between. Sides of pronotum a little guttate with blackish-fuscous; a large, round, piceous-black spot on central disc each side of median carina. Scutellum guttate with fuscous, a pair of blackish indented points near apex of disc. Tegulæ usually clouded with fuscous. Elytra mostly dark brown; costa and radius broadly white, unmarked; both branches of cubitus and third anal vein broadly white, unmarked; remaining veins broadly dark brown, interrupted with small whitish points. Ventral halves of epipleuræ heavily infuscated. A piceous-black spot between postocular process and eye, a large one of irregular shape behind each antennæ, prolonged dorsally, a third ventrad of centers of epipleuræ. Beneath somewhat infuscated.

LENGTH. From sulcus to tip of telson, male 4.3 mm., female 5 mm.; process, male 2 mm., female 2.3 mm.; greatest width, male 2.3 mm., female 2.6 mm.

The writer had before him specimens from Colorado and Utah, including 4 type specimens. A specimen from Utah is very lightly colored, the fuscous markings being very dim, but the color pattern is typical of the species, and an examination of the genitalia definitely places it systematically.

LOCALITY RECORD. Arizona, Colorado, and Utah. At present the range of the species is limited to the Rocky Mountain states.

Scolops grossus Uhler.

(Pl. LXVI, Figs. 2, 2a.)

Uhler. Bul. U. S. Geol. Geog. Surv.: I, p. 350; 1876.

Cephalic process very stout, rugose, heavily guttate with brownish; form robust; color a rich brown to yellowish; veins of elytra coarse, prominently marked with blackish fuscous.

STRUCTURAL CHARACTERISTICS. Head somewhat constricted behind eyes. Cephalic process short and stout, shorter than front in ratio of five to six, very nearly as wide as vertex when measured at sulcus, somewhat inflated toward tip, constricted at immediate tip, bent upward, rugose; tip prominently vertically carinate. Vertex nearly flat, rugose; caudal margin somewhat carinate, arcuated a little anteriorly; lateral margins carinate, flattened laterally over eyes, sinuate in front of eyes, diverged till over sulcus, continuing on process nearly parallel, then converged at immediate tip. Margins of front carinate; those of female subparallel, those of male converged anteriorly; sinuate mesad between eyes, constricted somewhat to sulcus, continuing on process diverging, then quickly constricted at tip, producing a decided inflated appearance; three carinæ of front equally prominent, median carina continuing on process to tip. Pronotum rugose, the sides a little granulose, lateral margins somewhat carinate, nearly straight, submarginal carinæ bending back toward lateral margins of central disc at posterior ends; caudal margin broadly arcuated anteriorly, incised at center; central disc broader than long in ratio of five to four; lateral margins carinate, straight, convergingly rounded anteriorly, median carina prominent. Scutellum broader than long in ratio of five to four; central disc flat, margins carinate, median carina present. Cubitus and media forking unequally, cubitus near junction of second and third anal veins, media farther back toward apex.

COLOR CHARACTERISTICS. Of a rich brown to yellowish. Front, process, ver-

tex, and pronotum heavily guttate with dark brown; scutellum and elytra clouded with dark brown; veins of elytra prominently marked with blackish fuscous; geminate indentations present, but inconspicuously colored. Beneath, light brown, guttate with darker. Wings smoky brown, veins darker.

LENGTH. From sulcus to tip of telson, male 4.6 mm., female 6.3 mm.; process, male 1.3 mm., female 2 mm.; greatest width, male 2.3 mm., female 3.3 mm.

Specimens are before the writer from western Kansas, eastern Colorado and Texas. This species shows the greatest differences in the relative sizes of the sexes, and is conspicuous for its massive, rugose, dark-colored process.

LOCALITY RECORDS. California, Colorado, Idaho, Kansas, New Jersey and Texas. Some of these records are questionable. It would be surprising if this species occurred in New Jersey, and the writer doubts the authenticity of the California record.

Scolops maculosus Ball.

Pl. LXVI, Figs. 1, 1a).

Ball. Can. Ent.: XXXIV, p. 148; 1902.

Cephalic process long and very stout, bent upward; form narrowly oval; elytra maculate with blackish-fuscous and whitish spots.

STRUCTURAL CHARACTERISTICS. Head not constricted behind eyes. Cephalic process long and stout, as long as front and as wide as vertex when measured at sulcus, usually parallel-margined, sometimes appearing a little inflated at tip. Vertex convex, shining, caudal margin not carinate; lateral margins carinate, acute, arcuated somewhat laterally over eyes, diverging till over sulcus, then converging again and continuing on process parallel to tip: Margins of front straight, somewhat carinate, converging anteriorly, constricted somewhat to sulcus, then continuing on process parallel to tip; three median carinæ of front equally prominent, median carina ending at sulcus. Lateral margins of pronotum somewhat carinate, broadly rounded; submargined carinæ becoming obsolete anteriorly; caudal margin very broadly arcuated anteriorly; incised at center; central disc broader than long in ratio of four to three; lateral margins carinate, usually nearly straight, sometimes a little sinuate mesad near centers, very broadly rounding anteriorly. Scutellum broader than long in ratio of eight to five; lateral margins of central disc carinate, median carina usually only indicated. Media and cubitus forking about equally near junction of second and third anal veins.

COLOR CHARACTERISTICS. Greyish testaceous, guttate with blackish fuscous above and below, elytra maculate with blackish fuscous and whitish, costa broadly white, unmarked. Vertex shining, a blackish-fuscous crescentic spot anteriorly, often interrupted in the center. Front often greenish yellow, lateral compartments of front and process made darker by irregular patches and spots of blackish fuscous which increases in density toward tip of process, making it appear darker laterally and anteriorly; central compartments of front and process unmarked. Sides of pronotum irregularly marked with blackish fuscous; a large, round piceous-black spot each side of median carina on central disc, another between postocular process and eye, a third behind each antenna, and a fourth ventrad of center of epipleura. Scutellum guttate with

blackish fuscous laterally, a pair of piceous-black spots on central disc apically. Tegulæ almost black. Veins of elytra alternately interrupted with large blackish-fuscous and whitish spots, a series of blackish-fuscous spots along apical margin. Wings smoky, veins darker.

LENGTH. From sulcus to tip of telson, male 4.6 mm., female 5 mm.; process, 1.6 mm.; greatest width, 2 to 2.3 mm.

Description based on a good series of specimens from Colorado and *New Mexico,* including 5 cotypes. The New Mexican record is additional to that given by Van Duzee.

Scolops immanis sp. n.

(Pl. LXVI, Figs. 3, 3a.)

Resembling *S. grossus* Uhler, but of a less robust form, and lighter, elytra nearly concolorous, the veins lacking the prominent, dark fuscous markings so characteristic of that species.

STRUCTURAL CHARACTERISTICS. Head not constricted behind eyes. Cephalic process short and stout, shorter than front in ratio of four to five, six-sevenths as wide as vertex when measured at sulcus, inflated toward tip, constricted at immediate tip, and bent upward; rugose; tip prominently vertically carinate. Vertex nearly flat, rugose; caudal margin somewhat carinate, arcuated a little anteriorly; lateral margins carinate, nearly straight, flattened laterally over eyes, sinuate in front of eyes, diverging until over sulcus, then converging again toward tip. Margins of front faintly carinate, subparallel, sinuate mesad between eyes, constricted somewhat to sulcus, continuing on process, diverging, then quickly converged at tip, producing a decided inflated appearance; three carinæ of front equally prominent, median carina continuing on process to tip. Pronotum rugose; lateral margins somewhat carinate, straight, submarginal carinæ bending back toward lateral margins of central disc at posterior ends; caudal margin narrowly arcuated anteriorly, incised at center; central disc as broad as long; lateral margins carinate, straight, convergingly rounded anteriorly, median carina prominent. Scutellum broader than long in ratio of four to three, smooth; central disc slightly concave, margins carinate, median carina present. Cubitus and media forking on oblique line with junction of second and third anal veins, cubitus further apically.

COLOR CHARACTERISTICS. Pale brownish to straw yellow. Front, process, vertex, and pronotum greenish. Heavily guttate with dark brown. Scutellum clouded with green and brown. Geminate indentations mostly wanting, only those ventrad of centers of epipleuræ present. Beneath, light brown, guttate with darker; legs heavily guttate with green and brown. Elytra pale brownish, unmarked; veins nearly concolorous, unmarked on male, but sparingly interrupted with minute whitish points on female. Wings diaphanous, veins darker.

LENGTH. From sulcus to tip of telson, male 5 mm., female 6.3 mm.; process, male 1.3 mm., female 1.6 mm.; greatest width, male 2.4 mm., female 3 mm.

Described from 1 male and 2 females from Scott county, Kansas, R. H. Beamer. Holotype, male; allotype and paratype deposited in the entomological collections, University of Kansas.

SYSTEMATIC TREATMENT OF SUBGENUS *BELONOCHARIS.*

SUBGENUS *Belonocharis* Uhler.

Uhler. Trans. Md. Acad. Sci.: I, p. 145; 1891.

In describing this group as a genus Uhler named many characters that are not generic, and failed, for the most part, to point out those that could be relied upon to identify the group. Opinions differ greatly as to the amount of variation necessary to warrant the erection of a genus. At present the writer doesn't think that the species now known to belong in this group display enough essential differences to warrant their complete separation from the genus *Scolops*. The principal ways in which these insects differ from *Scolops* are as follows: The plane of the vertex is above that of the pronotum, the eyes are distant from the pronotum, the fore and middle tibiæ are foliaceous, and the genitalia of the males show distinct differences in structure, as will be seen from an examination of the accompanying drawings. That these insects possess simpler structures than those of *Scolops* is shown by the greater simplicity of the male genitalia, and the fact that media is seldom branched before the apex.

The following species are recognized as belonging to this group: *S. fumidus* (Uhler), *S. pallidus* Uhler, and *S. abnormis* Ball.

KEY TO THE SUBGENUS *BELONOCHARIS.*

PAGE

A. Cephalic process slender, less than three-fourths as wide as vertex when measured at sulcus, tapering anteriorly; latero-dorsal carinæ broadly white.

B. Ground color black; media usually forking before apex of clavus. *S. fumidus* Uhler, 448

BB. Ground color pale yellowish; media rarely forking before apex of clavus. *S. pallidus* Uhler, 449

AA. Cephalic process stout, as wide, or wider, than vertex when measured at sulcus, inflated; all carinæ dark brownish..... *S. abnormis* Ball, 450

Scolops fumidus (Uhler).

(Pl. LXVI, Figs. 4, 4a.)

Uhler. Trans. Md. Acad. Sci.: I, p. 146; 1891; *Belonocharis.*
Piceus Van Duzee. Trans. San Diego Soc. Nat. Hist.; II, p. 35; 1914.

Piceous black, marked with whitish; cephalic process slender and tapering, brachypterous form broadly oval, macropterous form much larger, wings broadly flaring posteriorly.

STRUCTURAL CHARACTERISTICS. Head constricted behind eyes, eyes distant from pronotum. Cephalic process as long as front or longer, three-fifths as wide as vertex when measured at sulcus, bent upward and tapering anteriorly. Vertex slightly convex, shining; caudal margin very faintly carinate, straight; lateral margins very prominently carinate, nearly straight, converging anteriorly, sinuate mesad in front of eyes, then broadly flattened laterally over

sulcus, and continuing on process convergingly straight to tip. Front very broad, much narrowed anteriorly; lateral margins carinate, nearly straight, abruptly constricted to sulcus, then continuing on process subparallel to tip; five carinæ equally prominent, median carina becoming obsolete near sulcus, reappearing again near tip. Pronotum rugose; lateral margins carinate, broadly rounded; submarginal carinæ becoming obsolete anteriorly; caudal margin broadly arcuated anteriorly, incised at center; central disc broader than long in ratio of four to three; lateral margins carinate, sinuate mesad at centers, broadly rounded anteriorly; median carina present, acute. Scutellum broader than long in ratio of seven to five; central disc somewhat concave, lateral margins slightly carinate, median carina obsolete. Media and cubitus forking unequally, cubitus near junction of second and third anal veins, media farther back apically.

COLOR CHARACTERISTICS. Black, marked with whitish; elytra uniformly smoky hyaline, excepting costa which is much darker. Beneath guttate with whitish. Cephalic process piceous black, latero-dorsal and latero-ventral carinæ broadly whitish. Vertex piceous black, shining. Pronotum and tegulæ maculate with whitish. Disc of scutellum broadly whitish mesally and anteriorly. Front broadly whitish ventrally, guttate with whitish anteriorly.

LENGTH. From sulcus to tip of telson, male 4 mm., female 5.6 mm.; process, 1 to 1.3 mm.; greatest width, male 2.3 mm., female 3 mm.

Description based on specimens from California collected and loaned by Dr. E. D. Ball. A discussion of the synonymy of this species occurs elsewhere in this paper.

Scolops pallidus Uhler.

(Pl. LXVI, Figs. 5, 5a.)

Uhler. Trans. Md. Acad. Sci.: I, p. 404; 1900.

Pale yellowish gray, more or less marked with fuscous; cephalic process long and slender, tapering somewhat anteriorly, usually bent upward; form narrowly oval.

STRUCTURAL CHARACTERISTICS. Head constricted behind eyes, eyes distant from pronotum. Cephalic process longer than front, two-thirds as wide as vertex when measured at sulcus, bent upward and tapering somewhat anteriorly. Vertex nearly flat, somewhat rugose; caudal margin faintly carinate, straight; lateral margin prominently carinate, acute, straight, converging till over sulcus, then continuing on process subparallel to tip; five carinæ of front equally prominent, median carina becoming obsolete before sulcus. Pronotum rugose, lateral margins carinate, broadly rounded; submarginal carinæ bending back to lateral margins of central disc near centers; caudal margin narrowly arcuated anteriorly, scarcely incised at center. Scutellum broader than long in ratio of seven to five; central disc somewhat concave, lateral margins carinate, median carina wanting, a pair of large, round, indented points apically. Media not forking before apex, cubitus forking before junction of second and third anal veins.

COLOR CHARACTERISTICS. Pale yellowish gray, more or less infuscated; elytra almost white, the veins usually dotted with fuscous in various degrees of darkness, a fuscous cloud or two apically. Cephalic process blackish fuscous, latero-dorsal carinæ broadly whitish. Vertex heavily infuscated. Pronotum more or

less maculate with blackish fuscous. Scutellum pale yellowish gray, guttate with blackish fuscous laterally, a pair of large, round fuscous spots apically. Front and ventral compartments of process pale yellowish, usually guttate with fuscous.

LENGTH. From sulcus to tip of telson, male 4.6 mm., female 5.3 mm.; process, 1.6 to 2 mm.; greatest width, male 2.3 mm., female 2.6 mm.

Description based on specimens from California, Colorado, *Mexico,* and Utah. Van Duzee questions the Colorado and Utah records. Specimens from both places have been studied and that they represent this species is without question. The specimens from Colorado were taken at Rifle, which is on the western slope of the mountains.

Scolops abnormis Ball.

(Pl. LXVI, Figs. 6, 6a.)

Ball. Can. Ent.: XXXIV, p. 149; 1902.

Pale yellowish, guttate with fuscous; cephalic process long and very stout, inflated, bent upward; form broadly oval.

STRUCTURAL CHARACTERISTICS. Head constricted behind eyes, eyes distant from pronotum. Cephalic process longer than front, as wide as vertex when measured at sulcus, or wider, bent upward and inflated somewhat anteriorly. Vertex nearly flat, rugose; caudal margin not carinate, median carina sometimes present; lateral margins very prominently carinate, straight, nearly parallel, continuing on process convergingly straight to tip. Front slender, narrowed anteriorly; lateral margins carinate, straight, constricted a little to sulcus, then continuing on process, diverging a little toward tip, abruptly converged at immediate tip; five carinæ of front equally prominent, median carina becoming obsolete before sulcus. Pronotum rugose; lateral margins carinate, broadly rounded; submarginal carinæ bending back to lateral margins of central disc caudad of centers; caudal margin broadly arcuated anteriorly, scarcely incised at center; central disc broader than long in ratio of four to three, lateral margins carinate, nearly straight, converging anteriorly; median carina present, acute. Scutellum broader than long in ratio of four to three; central disc somewhat concave, lateral margins carinate, roundly converged anteriorly, median carina wanting. Media not forking before apex, cubitus forking near junction of second and third anal veins.

COLOR CHARACTERISTICS. Pale greyish testaceous, body more or less guttate with browish; elytra pale yellowish white, the veins usually dotted and spotted with blackish fuscous, often unmarked. Cephalic process brown, with small, light maculations. Vertex infuscated; a pair of indented points on disc of pronotum, another on scutellum apically, colored to various degrees of darkness. Front pale yellowish, unmarked.

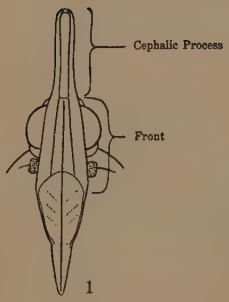
LENGTH. From sulcus to tip of telson, male 5 mm., female 5.6 mm.; process, male 1.6 mm., female 2.6 mm.; greatest width, male 2.3 mm., female 3 mm.

Description based on a fine series of specimens from California, *Washington* and *Oregon.* This species displays a great variation in the density of the fuscous markings, some specimens appearing to be nearly concolorous. Italics indicates locality records not listed by Van Duzee.

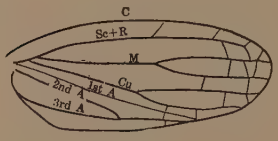
PLATES.

(451)

PLATE LXIII.



1



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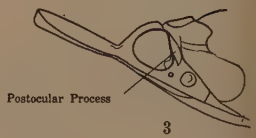
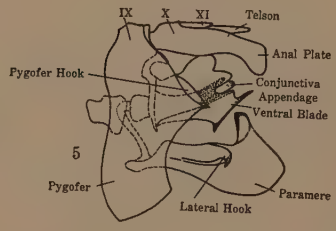


3

4

Copulatory Attachment

7a



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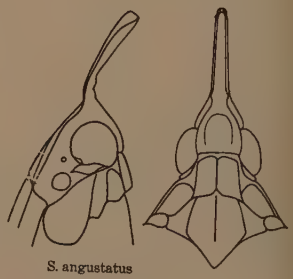
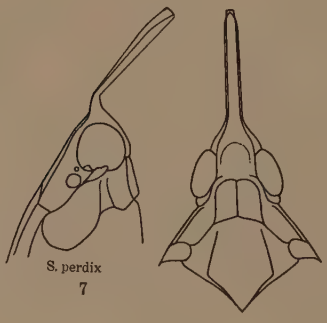


S. angustatus

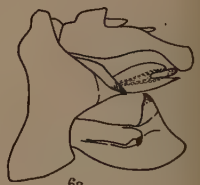
6

8a

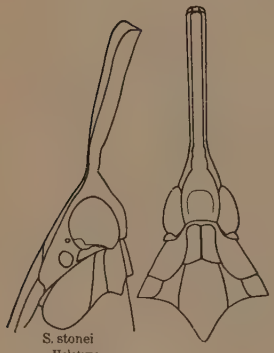


S. perdix

7



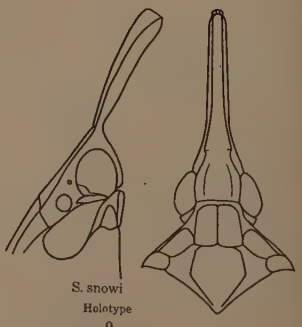
6a



S. stonei
Holotype

8

9a



S. snowi
Holotype

9

PLATE LXIV.

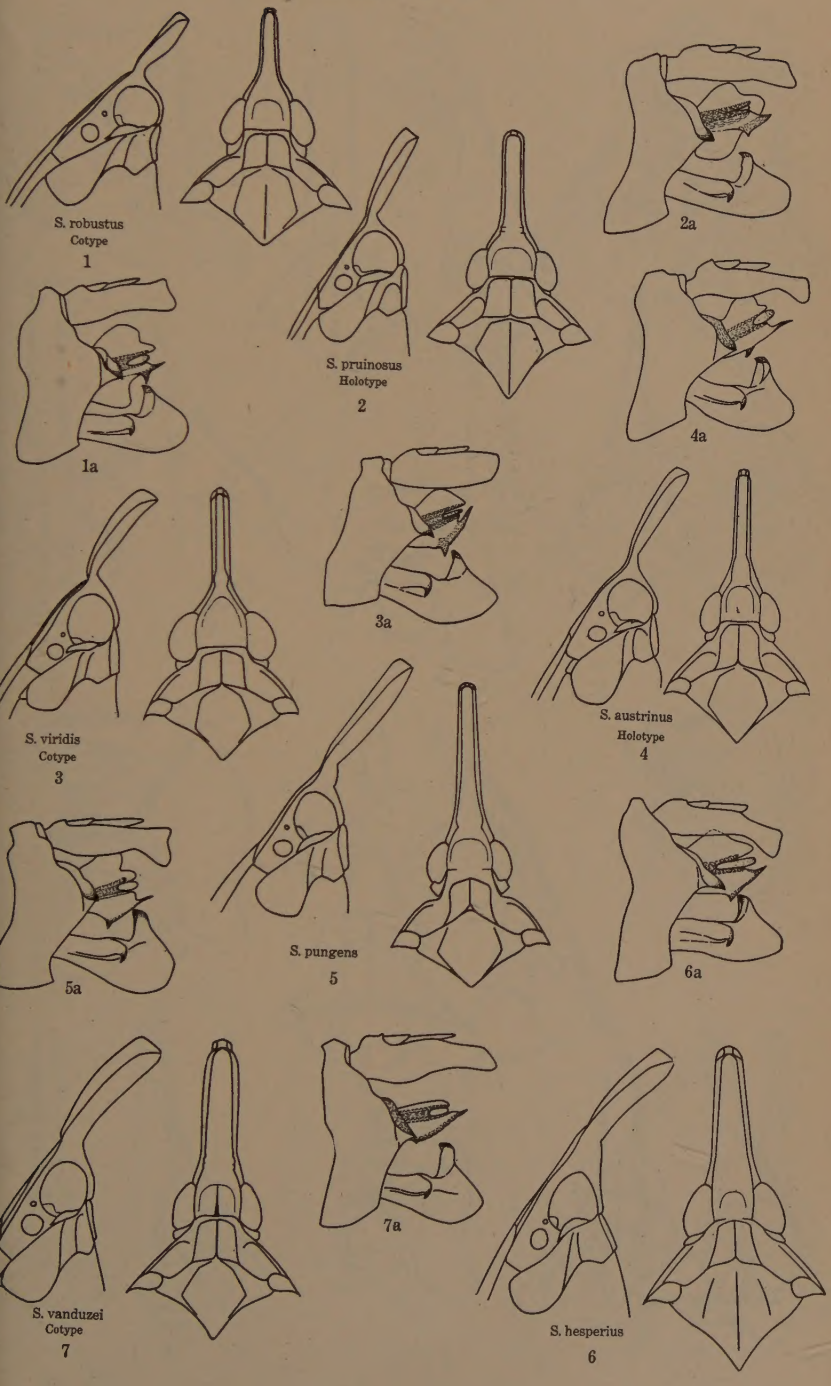
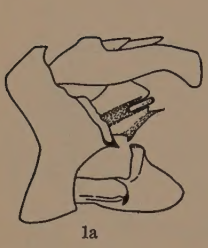
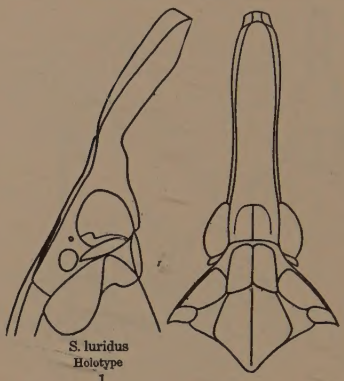

S. robustus
Cotype
1
1a
S. pruinosus
Holotype
2
2a
4a
3a
S. viridis
Cotype
3
S. austrinus
Holotype
4
5a
S. pungens
5
6a
S. vanduzei
Cotype
7
7a
S. hesperius
6

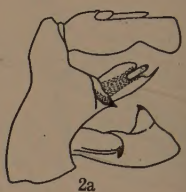
PLATE LXV.



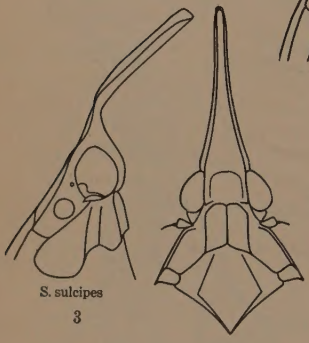
1a



S. luridus
Holotype
1

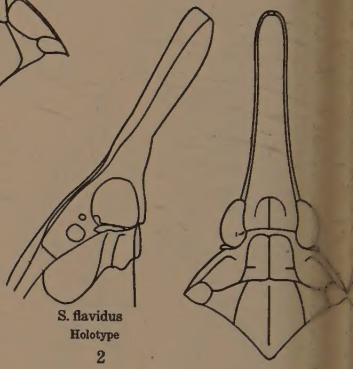


2a

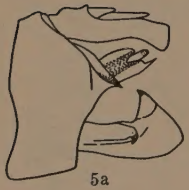


S. sulcipes
3

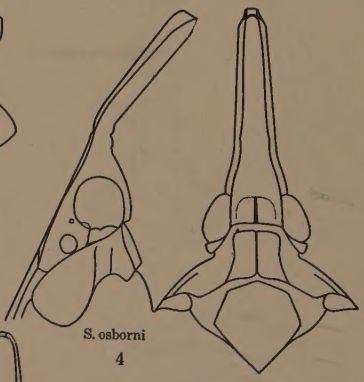
3a



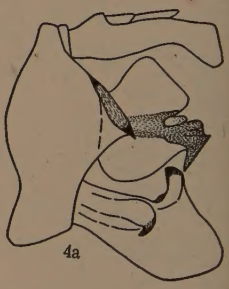
S. flavidus
Holotype
2



5a



S. osborni
4



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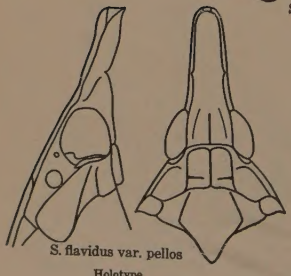
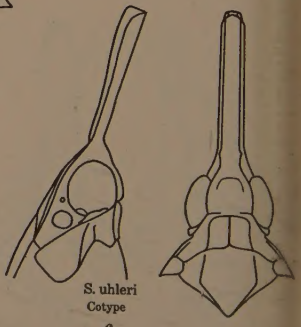


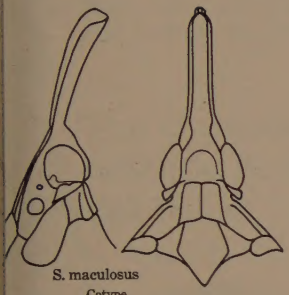
S. flavidus var. pellos
Holotype
5

6a



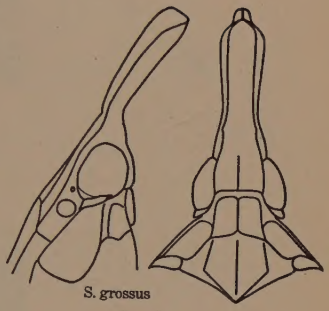
S. uhleri
Cotype
6

PLATE LXVI.



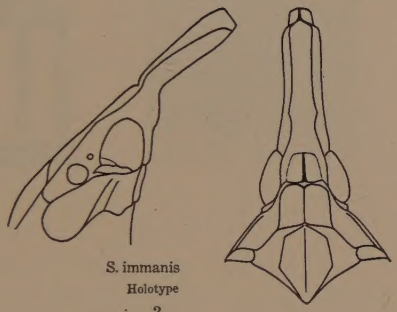
S. maculosus
Cotype
1

1a



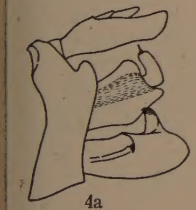
S. grossus
2

3a

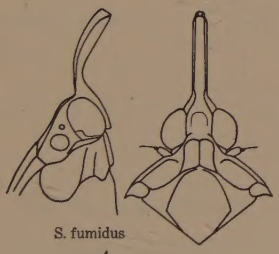


S. immanis
Holotype
3

2a

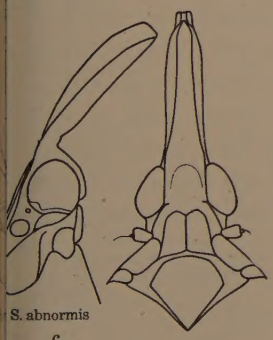


4a

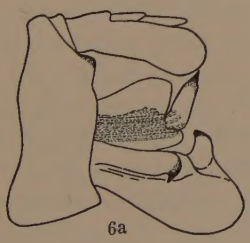


S. fumidus
4

5a



S. abnormis
6



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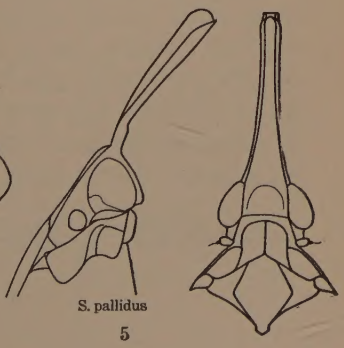

S. pallidus
5